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ABSTRACT

A study was conducted to investigate further the dichotic outcomes in right-handers as a function of sex, ear-side, and most especially stronger attentional bias. The derived prediction was: that increased focus time on the right side would produce a striking right ear advantage (REA) in either right-handed men or women, replicating the most recent findings with instruction manipulations. Subjects were 24 right-handed women and 24 right-handed men; all subjects were undergraduate students. Subjects were told they would be hearing a series of simple sounds which would be presented in each ear simultaneously. For the first block of 120 trials, subjects were instructed to focus their attention on one prespecified ear and report only those sounds coming from that ear. After a one-minute rest, the second block of 120 trials was given and the subjects had to shift their attention to the unattended ear-side and perform the necessary identifications. Analysis indicated a very strong right-ear advantage in men and women under the right-focus condition as well as a significant left-ear advantage for both sexes with directed left-focus. These findings suggest that sustained ear-attendance exerts a powerful influence on dichotic performance. More work is required with attentional manipulations to determine their relative impact on right-handers' dichotic identifications. (One table is included and eighteen references are attached.) (MG)

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The Influence of Strong Attentional Manipulations on the Processing of Dichotic Inputs in Right-Handers

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Summary

Recent studies have shown that a pronounced right-ear advantage can occur within dichotic tasks when a particular sex is directed to focus its attention onto the right ear. To examine the effects of attentional bias on laterality more precisely, we provided subjects a greater number of focused ear trials. Analysis indicated a very strong right-ear advantage in men and women under the right-focus condition as well as a significant left-ear advantage for both sexes with directed left-focus. These findings suggest that sustained ear-attendance exerts a powerful influence on dichotic performance.

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The Influence of Strong Attentional Manipulations on the Processing of Dichotic Inputs in Right-Handers

A right-ear advantage (or left hemisphere superiority) has often been found when verbal materials are presented during dichotic listening tasks while, conversely, a left-ear advantage (or right hemisphere dominance) has been reported for musical stimuli as well as other nonlinguistic sounds (Curry, 1967; Kimura, 1964). More current research, however, indicates that not all subjects possess this asymmetrical type of hemispheric organization. Levy (1972, 1976) theorizes that in females and left-handers, both hemispheres have developed a "verbal blueprint" which allows linguistic skills to be represented bilaterally. The argument then follows that no ear advantage will be evidenced in these groups when processing materials of a verbal nature since both hemispheres are equally adept at handling the input. Support for Levy's theory comes from a number of dichotic studies which have shown that some females and left-handers do not demonstrate these right-ear preferences (Hicks & Kinsbourne, 1978; Knox & Kimura, 1970; Lake & Bryden, 1976; McGlone & Davidson, 1973; McKeever & Van Deventer, 1977; Zurif & Bryden, 1969).

Recently, Bryden (1980a, 1986) has identified a possible confounding factor which may be contributing to some of these asymmetric outcomes in dichotic tasks, namely, attentional bias (i.e., the focusing of attention on only one ear-side across counterbalanced blocks of trials). Bryden's results have clearly indicated a more striking right-ear advantage (REA) for individuals in the "focused attention" group, in comparison to those who were simply given the standardized dichotic instructions to divide their attention between both ears. We have also consistently observed this focused attention effect in our right-handed males (Iaccino & Sowa, 1989). Hiscock and Hiscock (1988) have surprisingly reported that right-handed women might even show a stronger REA than men if particular stimulus cues are provided in dichotic tasks, suggesting that instruction manipulations may have a direct influence on the laterality observed in a particular sex. The question then stands, would this REA continue to be shown in men (or women) when more trials were provided to attend to inputs coming from one ear-side.

The present experiment was, therefore, designed to investigate further the dichotic outcomes in right-handers as a function of sex, ear-side, and most especially

stronger attentional bias. With respect to the latter factor, we employed larger-sized attendance blocks (of 120 focused trials with each ear) to ensure that subjects would have fewer problems in shifting their "attentional set" from one ear to the other. Our derived prediction was: that increased focus time onto the right side would produce a striking REA in either right-handed men or women, replicating the most recent findings with instruction manipulations.

Method

Subjects and Design

Initially, Annett's (1970) handedness questionnaire was distributed to a number of introductory and advanced psychology classes to determine the hand preference of as many undergraduate subjects as possible (N = 241). The 12-item questionnaire asked subjects to judge which hand they used most across a wide range of manual activities (i.e., throwing a ball, writing a letter). Employing Nagae's (1983) scoring procedure, we assigned a score of -1 to every left response that was provided by each subject, a score of +1 to every right response, and a 0 to every either response that occurred. Those subjects with the strongest right-hand dominance (n = 48) were

subsequently chosen to participate in the main experiment, earning extra-credit points for their voluntary assistance.

The 48 undergraduate students (M = 19.9 yr.) were equally divided by sex, with their mean hand dominance as follows: 24 right-handed men = 11.03 (SD = 1.54) and 24 right-handed women = 10.98 (SD = 1.60). The between-subjects factor, sex (man, woman), along with two within-subjects factors, ear-side (left, right) and instructions (left-focus, right-focus), were employed in a 2 x 2 x 2 factorial design which analyzed the average number of correct identifications within the dichotic listening task.

Stimulus Materials and Apparatus

The presentation of the dichotic sounds was basically derived from the Bryden, Munhall, and Allard (1983) experiment. Initially, a male speaker read off pairs of the following consonant-vowel (CV) syllables: ba, da, ga, ka, pa, and ta. In the formation of the pairs, each CV syllable was randomly matched with every other syllable four times, generating 60 spoken pairs.

After the 60 pairs were recorded on Maxell High-Grade VHS videotape, each of the pairs was then matched for presentation synchrony to within an error rate of .03 sec.

by using a Panasonic stereo-editing system (Model No. NV8500), which also allowed for proper sound balancing between the left and right channels. Each pair was also edited to a common duration of 500 msec., with an interstimulus interval of 5 sec. between pairs. The 60 stereo-edited pairs were then reproduced four times, giving a total of 240 trials, which were divided into two blocks of 120 trials each for each ear-side. Finally, the 240 pairs were directly copied onto Maxell High-Grade cassette tapes and subsequently played to subjects at a moderate volume through a Sony High-Bass Output Walkman with attachable stereoheadphones (Model No. WM-AF44).

Procedure

Subjects were told that they would be hearing a series of simple sounds which would be presented in each ear simultaneously. For the first block of 120 trials, subjects were instructed to focus their attention on one prespecified ear and report only those sounds coming from that ear. On the second block of 120 trials, subjects had to shift their attention to the unattended ear-side and perform the necessary identifications. Left and right ear-sides were counterbalanced between (as well as within each of) the sexes for the block presentations. All subjects were provided with a 1-min. rest before they

switched attention to the alternate side for the remaining trials. A prerecorded 45-dB tone announced the start of the second block of trials.

Unlike the Bryden, et al. (1983) methodology, subjects did not have to shift back-and-forth from one ear to the other across a series of smaller trial blocks; rather, our blocks (which were twice the size of Bryden's, et al.) were designed to provide for better attentional focus in each ear. The number of correct identifications in both attended as well as unattended ear-sides for each subject was subsequently tabulated and incorporated in the major three-way analysis of variance.

Results

The 2 x 2 x 2 design yielded main effects for ear-side and instructions ($F_{1,45}$ = 21.69, MSe = 4.15, $p < .01$ and $F_{1,45}$ = 12.09, MSe = 4.15, $p < .01$, respectively). Syllable identifications were better for the right ear than the left, with Ms (and SDs) = 63.79 (3.15) and 42.68 (3.23); and instructions to focus on the right side generated more correct responses than ones directed to the left side, with Ms (and SDs) = 56.71 (3.12) and 49.76 (3.26). Also as predicted, the interaction of ear-side x instructions was significant ($F_{1,45}$ = 14.42, MSe = 2.86, $p < .01$). Scheffé post hoc comparisons of the means

showed that the best identifications occurred in the right ear when subjects were instructed to attend to that respective side (M = 88.02) while the worst performance was in the unattended left ear with these right-focus instructions (M = 25.40), highlighting the hypothesized right-ear advantage for syllables. Surprisingly, a significant ear difference was also evidenced for the left-focus instructions, with the left ear benefiting performance more than the unattended right (with respective Ms = 59.96 and 39.56).

Though the main effect for sex was not significant ($F < 1.00$), the three-way interaction of sex x ear-side x instructions ($F_{1,45} = 11.32$, MSe = 2.60, $p < .01$) revealed some interesting findings between men and women. Not only was a right-ear advantage demonstrated for men under the right-focus instructions, but the same REA was shown for women with these instructions upon Scheffé testing.

Insert Table 1 about here

As depicted in Table 1, both sexes profited from focusing their attention on the right ear in comparison to the left (with male Ms = 89.75 and 22.00 and female Ms = 86.29 and 28.79, respectively). A less powerful, though

still significant, LEA was also present in each sex, with the left-ear -- left-focus condition surpassing the corresponding right-ear. Post hoc testing further revealed that the LEA in men was stronger than in women.

These results suggest that if attention can be sustained on a particular ear-side, a laterality effect can be obtained in either sex. Although we did not anticipate these effects to be so strong (especially the LEA in men and women), we could not necessarily predict the influence of greater focusing time on each ear as this variable was never directly manipulated before. Suffice it to say, fewer attentional shifts between ears seem to contribute to more pronounced asymmetrical outcomes in men and women.

Discussion

To summarize our findings, it was apparent that attentional bias (of the sustained type) exerted a powerful influence on dichotic performance in right-handers, replicating our previous results (Iaccino & Sowa, 1989) and others (Bryden, 1980a, 1983, 1986; Hiscock & Hiscock, 1988). Further, the "attentional set" strategy employed by men (as posited by Bryden, 1980b) could be adopted by women provided there were a sufficient number of ear-focus trials. This attentional manipulation also

made it possible to obtain left-(as well as right-) ear advantages with the dichotic materials, suggesting that these tasks were not as hemisphere-dependent as previously supposed.

It is apparent that more work is required with attentional manipulations to determine their relative impact on right-handers' dichotic identifications. Definitely the claim of greater right-ear advantages in men needs to be reconsidered in light of the present findings. The weaker left-ear advantage evidenced in both sexes with focused instructions onto the left side further highlights the importance of continued study with this variable. Left-handers' performance within dichotic tasks should also be more thoroughly examined under more concentrated attention conditions like ours in order to see whether these same ear advantages would occur between men and women.

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Table 1

Mean Number Correct Identifications as a Function of Sex, Ear-side, and Instructions

Sex		n	Ear-side			
			Left		Right	
			M	SD	M	SD
Men	Left-Focus	48	63.04	3.48	36.96	3.18
	Right-Focus	48	22.00	3.26	89.75	3.02
Women	Left-Focus	48	56.88	3.11	42.17	3.29
	Right-Focus	48	28.79	3.10	86.29	3.13